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PATENT SPECIFICATION (11) 1 530 461

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(21) Application No. 8637/75 (22) Filed 28 Feb. 1975

(23) Complete Specification filed 25 Feb. 1976

(44) Complete Specification published 1 Nov. 1978

(51) INT. CL.² F16D 55/224 65/02

(52) Index at acceptance F2E 2N1C3 2N1D16 2N1E5 EI EL

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(54) MOVABLE-CALIPER DISC BRAKE ASSEMBLIES

(71) We, GENERAL MOTORS FRANCE, a Body Corporate under the laws of France, of 56-68 Avenue Louis Roche, 92 Gennevilliers, Seine, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:

This invention relates to movable-caliper disc brake assemblies suitable for automobiles. By "movable-caliper" is meant the class of disc brake assemblies in which, to apply the brake, one of the shoes is directly moved into contact with one face of the disc and by reaction movement of the caliper the other shoe is applied to the other face of the disc.

It is an object of the invention to provide a design which allows the shoes to be replaced through an opening in the bridge of the caliper, without removing the caliper. Also, by the invention, an improved distribution of material may be employed, as between the fixed bracket and the caliper, which enables weight reduction without impairing satisfactory taking-up of the braking torque.

A movable-caliper disc brake assembly according to the invention comprises a rotary disc, a stationary carrier bracket located wholly to one side of the disc and having two arms spaced circumferentially of the disc, a caliper straddling the disc and slidably supported between the carrier bracket arms by a pair of pins, one at each end, each pin fitting into opposed grooves in slidably contacting abutment surfaces in the caliper and in the adjacent arm of the bracket respectively, and a pair of brake shoes mounted on opposite sides of the disc within a closed aperture in the caliper and arranged to transmit braking torque by contacting one of two circumferentially-spaced end portions of the caliper, adjacent such aperture.

The appended claims define the scope of the monopoly claimed. How the invention can be performed is hereinafter particularly described with reference to the accompanying drawings in which:

Figure 1 is a plan view of the assembly;

Figure 2 is an elevation of Figure 1 viewed in the direction of arrow 'A' in Figure 1;

Figure 3 is an elevation of Figure 1 viewed in the direction of the arrow 'B' in Figure 1;

Figure 4 is an end view of the assembly according to the invention;

Figure 4A is a view of one pin assembly referred to below;

Figure 5 is a view similar to Figure 2 but with part cut away to show the retention of one brake shoe in the caliper;

Figure 6 is a section on line VI-VI of Figure 5; and

Figures 7 and 8 are views of one brake shoe and respectively show two further ways of retaining the shoe in position.

Figures 2 and 3 are views of the assembly as seen looking in opposite directions in relation to an automobile in which the assembly is installed. The wheel and associated parts of the automobile are omitted from the drawings, for sake of clarity, and will not be described here as they form no part of the present invention. But in Figures 1 and 4 the wheel should be imagined at the left of the Figure. The term 'outboard' as here used refers to a portion of the

assembly, relative to a disc of the assembly, that is viewed by an observer standing outside the automobile and looking in the direction of the arrow 'A' in Figure 1. In this view the observer would look through the wheel at the assembly behind it. The term 'inboard' refers to a portion of the assembly, relative to said disc, that is viewed in the opposite direction, that of the arrow 'B' in Figure 1, looking from within the automobile outwards. In this view the assembly would lie in front of the wheel as viewed by the observer.

The assembly 1 includes a rotary disc 2 fixed to a stub axle in the case of a front wheel brake or to an axle drive shaft in the case of a rear wheel brake, and a stationary carrier bracket 4 having holes 13 therein for the insertion of bolts (not shown) to secure the stationary carrier bracket to fixed structure (not shown) which could be part of a steering knuckle and mounting bracket in the case of a front wheel brake. The stationary carrier bracket 4 is wholly to one side of the disc, that is to say, it does not overhang the disc edge (see Figures 1 and 4). The stationary carrier bracket 4 has two arms 6, spaced circumferentially of the disc. A caliper 8 is mounted, in a manner to be described below, between the arms 6 for sliding movement in directions substantially parallel to the rotational axis of the disc. The caliper 8 has opposed inboard and outboard limbs 10, 12 which are connected by a bridge portion 14 so as to straddle the disc. In the structure forming the limbs and bridge portion is a through aperture 16 of substantially rectangular form comprising circumferentially spaced end margins 16a and axially-spaced side margins 16b, so dimensioned that two brake shoes 18, 20 may be inserted through the aperture from the outside of the assembly, to be positioned one on each side of the disc 2. The brake shoes are carried at their ends 22 on a pair of pins 24, 26 (which may be roll pins) secured in the limbs 10, 12 and extending across the aperture 16 substantially parallel to the rotational axis of the disc and adjacent respective end portions 28, 30 of the caliper bridge portion 14.

When fluid under pressure is supplied, by way of an inlet 32, to a piston 33 (Figure 2) slidable in a cylinder 34 forming part of the inboard limb 10 of the caliper 8, the adjacent brake shoe 18 is applied directly to one face of the disc 2. By reaction and the resultant sliding of the caliper 8 on the stationary carrier bracket 4 the other shoe 20 is applied by the outboard limb 12 to the other face of the disc 2. A bleed screw 36 is also provided. As is usually the case, the cylinder 34 has a resilient seal ring (not shown) which also acts to provide a return spring loading for the piston 33.

The support of the caliper for the necessary sliding movement will now be described. An abutment surface of each arm 6 of the stationary carrier bracket has a groove 38 therein, approximately semi-circular in cross-section. The inboard limb 10 of the caliper has two facing abutment surfaces 42, 44, each of which has an approximately semi-circular section groove 40 therein. The caliper is positioned on the stationary carrier bracket 4 so that the respective facing grooves 38, 40 face one another to form two approximately cylindrical, apertures and the abutment surface on each arm 6 comes into slidable contact with the corresponding abutment surface on the caliper 8. A pin assembly 48 is inserted through each aperture to retain the caliper on the stationary carrier bracket 4, and guide it for the necessary sliding movement on the stationary carrier bracket. The pin assemblies 48 provide a shock absorbing and anti-rattle retention of the caliper but are not relied on to transmit braking torque to the stationary carrier bracket 4. Each pin assembly 48 (of which one is illustrated in Figure 4A) comprises a pin 50 having a head 52, a stem 54, a spring in the form of a split cylinder 56 around the stem 54, and a fastener 58, which may conveniently be a lock washer, which co-operates with the head 52 to locate the assembly axially relative to the stationary carrier bracket 4. Once the caliper is located with its radially inner part between the arms 6 of the stationary carrier bracket 4 with the facing grooves 38, 40 forming the cylindrical through apertures, the pin assemblies are inserted through the apertures so that the pin heads 52 bear against the adjacent end surfaces of the stationary carrier bracket, and the lock washers 58 are secured on the ends of the stems 54 to fasten the assemblies in place relative to the stationary carrier bracket 4.

The resilience of the split cylinders 56 provides for shock absorption and avoidance of rattle between the caliper and stationary carrier bracket.

As the brake shoes wear, the caliper slides inboard along the pin assemblies 48. The

width of the bracket 4 at the grooves 38 is such as to accommodate pin assemblies having a length of stem sufficient to accept the entire movement of the caliper 8 resulting from total wear of the outboard brake shoe 20. Lining wear of the inboard shoe 18 is taken up by advance of the piston 33.

Brake torque is transmitted directly from the brake shoes 18, 20 to one or other of the circumferentially spaced end portions 28, 30 of the caliper bridge portion 14, depending upon the direction of rotation of the disc 2. Braking engagement of the shoes 18, 20 with the rotating disc 2 results in the shoes being dragged by the disc until they abut one or other of the end portions 28, or 30 of the caliper bridge portion 14, at the end margin 16a of the rectangular aperture, and by this abutment brake torque is transmitted directly from the shoes to the caliper, and is then transmitted from the caliper to the stationary carrier bracket 4 by reason of the contact of the caliper abutment surfaces 42, 44 with the stationary carrier bracket through the respective abutment surfaces of the arms 6.

In order to permit sliding of the brake shoes 18, 20 along the pins 24, 26, and to provide for sufficient movement of the shoes in directions substantially parallel with the disc sides when dragged by the disc, the shoes may be supported in the manner shown in Figures 5 and 6. Part of Figure 5 is broken away to show a detail of one brake shoe 20, which has a slot 60 (only one of which is shown) at each end of the shoe. The slot has a width such that the pin 24 or 26 is a close fit therein. The pins 24, 26 are longitudinally split cylinders of resilient metal and act in the Figure 5 retention means as springs imposing a loading on the brake shoes because of their engagement in the shoe slots 60. Each pin is received in through holes or bores 62, 64 in the inboard 10 and outboard 12 limbs respectively of the caliper 8. The holes or bores 64 in the outboard limb 12 (of which one hole is shown in Figure 6) have a smaller diameter outer end portion 66, which is less than the diameter of the pins 24, 26. The junction 67 between the two different diameter portions of the hole in the outboard limb 12 acts as a stop to prevent movement of the pin 24 or 26 out of the hole. Friction between the brake shoe and pins tending to drive the pins out of the holes in the caliper limbs could develop as the inboard shoe 18 is moved outboard to take up lining wear in both inboard and outboard shoes. The stop 67 acts to prevent any such movement occurring. The resilience of the pins 24, 26 is such that each absorbs shock and enables the pins to act as an anti-rattle device, yet permits movement of the shoes on the pin as a result of brake application and release.

Figures 7 and 8 show two further ways of retaining the shoes in the caliper. Both ways may use split pins as detailed above, but differ in the slot arrangement in the shoes. Since both brake shoes have a similar slot arrangement, the description for one shoe 18, applies equally to the other shoe 20, and for brevity only one shoe arrangement will be described with respect to each of Figures 7 and 8. As seen in Figure 7 the shoe 18 has a single slot 68 therein having a curved upper side so that the slot is wider at the ends 69 than in the middle. The slot length is such as to allow movement of the shoe into abutment with one or other end margin 16a of the aperture in the caliper bridge portion 14, depending upon the direction of rotation of the disc, without transfer of the braking torque to the pins 24, 26. The slot ends 69 have a width greater than the diameter of the pins 24, 26. A bowed spring 70 is inserted into the shoe slot across the caliper aperture and hooked ends 72 are so positioned as to engage the pins 24, 26. The bowing of the spring is such that its centre portion engages the curved upper side of the slot and reacts between the upper side and the pins so imposing a loading upon the shoes and the pins sufficient to hold the shoe in place in rattle-free manner, yet allow of the necessary movement for braking and release from braking throughout the total wear of the lining and disc.

In Figure 8, the slot 73 has parallel straight sides, has a width greater than the diameter of the pins 24, 26, and the spring 74 inserted in the slot has a stepped centre portion 76 as well as hooked ends 78. The stepped portion 76 of the spring bears against one side of the slot, and the hooked ends 78 engage the pins 24, 26. The spring acts in the same manner and to the same effect as the spring 70 of Figure 7.

Both springs 70 and 74 span the entire opening 16 in the caliper and can of course take any number of shapes to accommodate the environment provided by the disc and shoe slots.

An assembly according to the present invention has the advantages that, since the stationary carrier bracket is wholly to one side of the disc and thus does not overhang the disc, the amount of material in the bracket is thus significantly reduced, by the omission of any parts outboard of the disc. The sliding parts at the interface of the caliper and bracket are not subjected to the heat levels seen when mounted directly over the disc. The weight of caliper material is somewhat increased, in compensation, in the part of the caliper inboard of the disc, however, the caliper bridge bending moment, during braking, is significantly reduced as compared with that applied to the bridge of calipers that are very short in the section overhanging the disc. The more favourable, tensile, load is imposed upon the lesser weight of material bounding the caliper aperture containing the shoes. An overall weight reduction can be achieved in this way.

The brake shoes may be replaced without removal of the caliper or bracket. The brake shoes are free to slide over the spring and pins without restriction until all lining is gone and the disc has worn away.

WHAT WE CLAIM IS:

1. A movable-caliper disc brake assembly comprising a rotary disc, a stationary carrier bracket located wholly to one side of the disc and having two arms spaced circumferentially of the disc, a caliper straddling the disc and slidably supported between the carrier bracket arms by a pair of pins, one at each end, each pin fitting into opposed grooves in slidably contacting abutment surfaces in the caliper and in the adjacent bracket arm respectively, and a pair of brake shoes mounted on opposite sides of the disc within a closed aperture in the caliper and arranged to transmit braking torque by contacting one of two circumferentially-spaced end portions of the caliper adjacent such aperture.

2. A disc brake assembly according to claim 1 in which the end portion of the caliper contacted by the brake shoes is one of the circumferentially-spaced end margins of said aperture, which is substantially rectangular.

3. A disc brake assembly according to claim 1 or claim 2, in which the brake shoes are supported by pins supported by axially spaced side portions of the caliper material surrounding said aperture.

4. A disc brake assembly according to claim 3, in which each pin supporting a brake shoe is a longitudinally split cylinder of resilient metal.

5. A disc brake assembly substantially as hereinbefore particularly described with reference to and as shown in Figures 1 to 6 of the accompanying drawings.

6. A disc brake assembly substantially as hereinbefore particularly described with reference to and as shown in Figures 1 to 6 of the accompanying drawings as modified by Figure 7.

7. A disc brake assembly substantially as hereinbefore particularly described with reference to and as shown in Figures 1 to 6 of the accompanying drawings, as modified by Figure 8.

J N B BREAKWELL
Chartered Patent Agent

Printed by Her Majesty's Stationery Office, Reprographic Centre, Basildon, Essex, 1978.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1 530 461
5 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

FIG. 1.

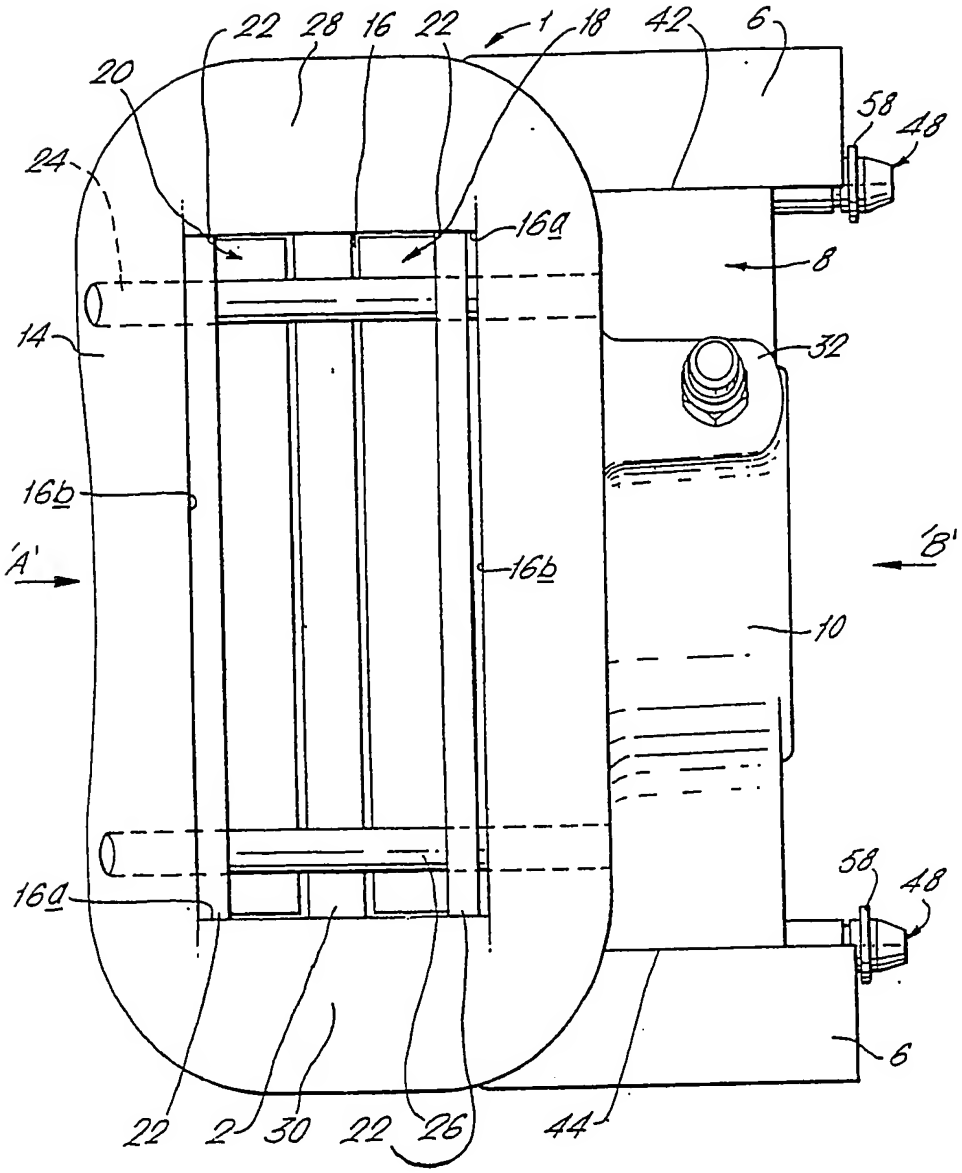

FIG. 2.

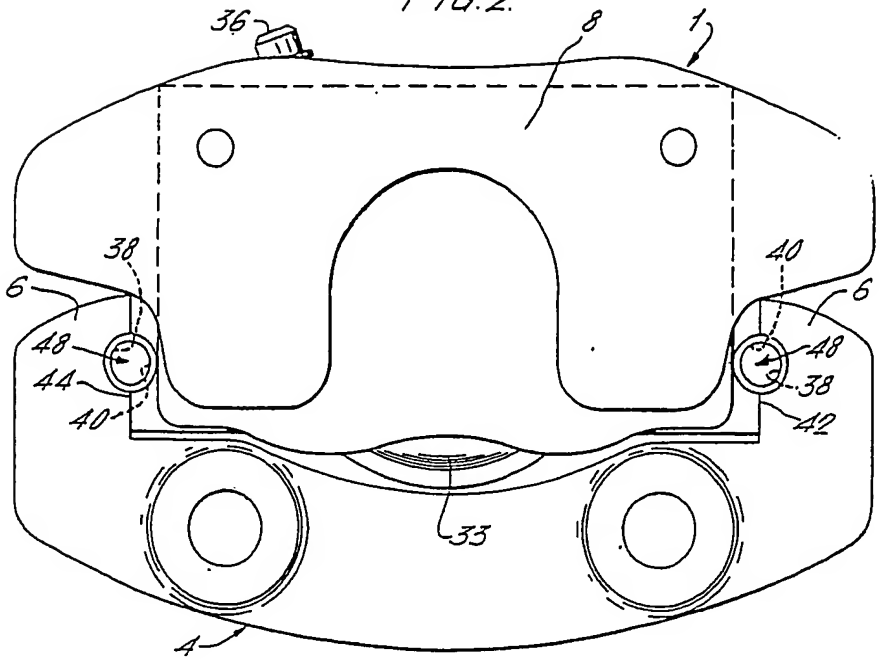
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FIG. 3.

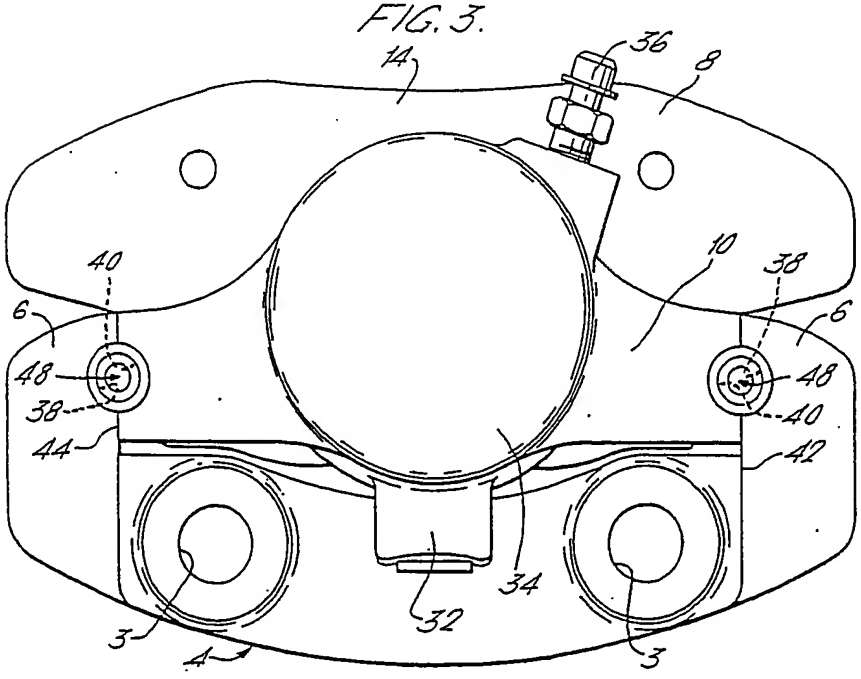
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FIG. 4.

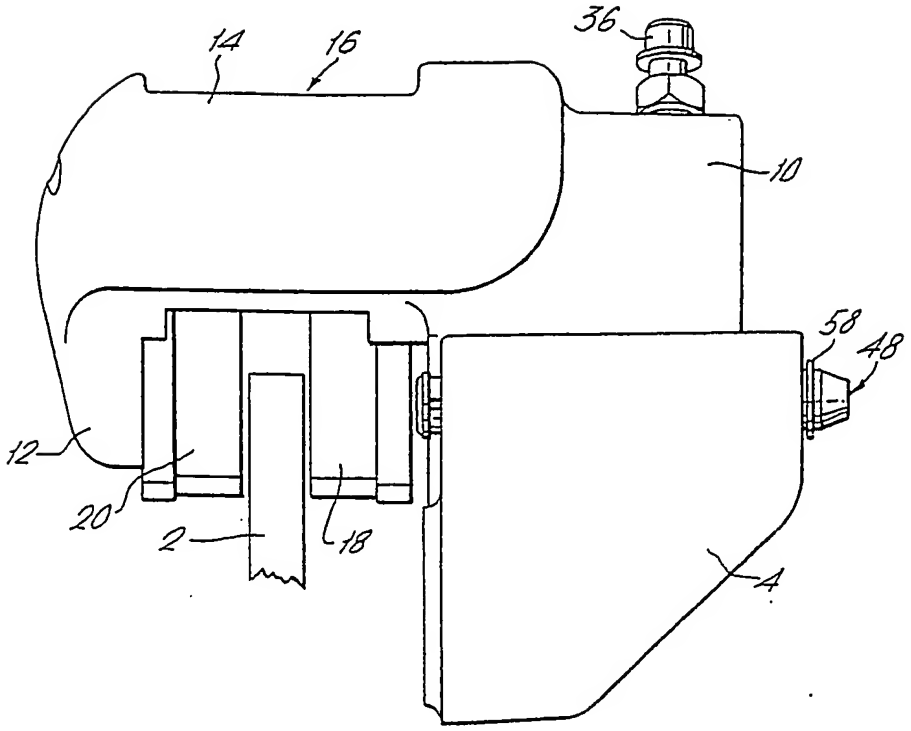

FIG. 4A.

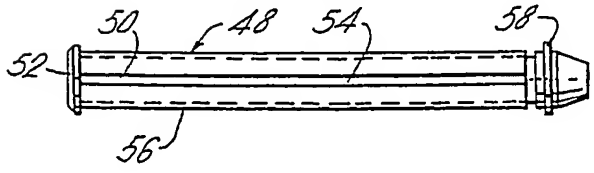

FIG. 5.

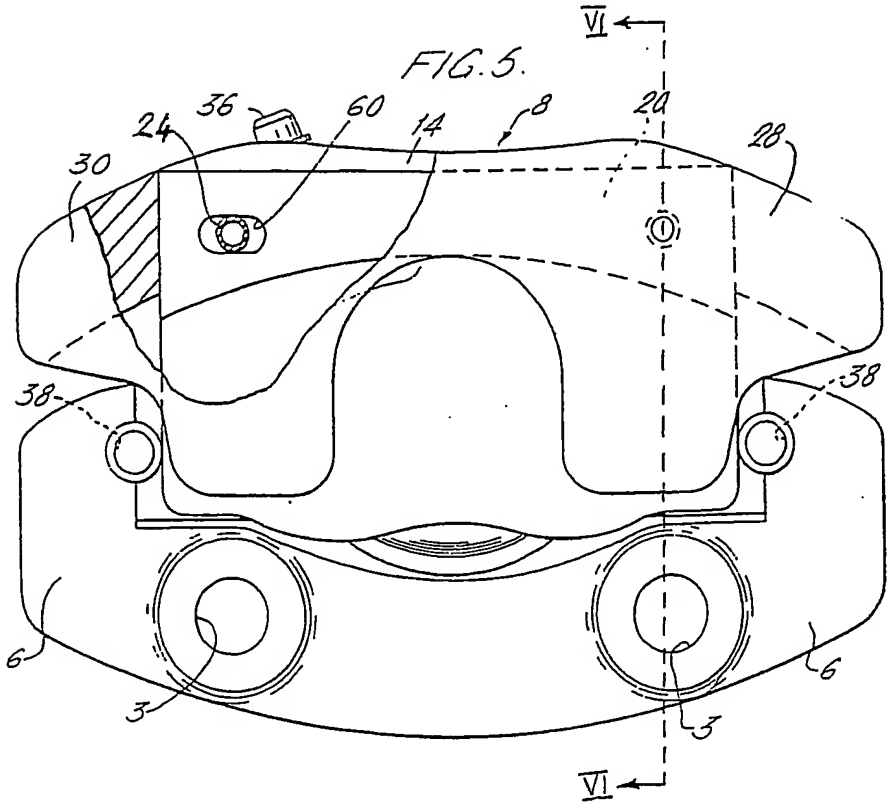

FIG. 6

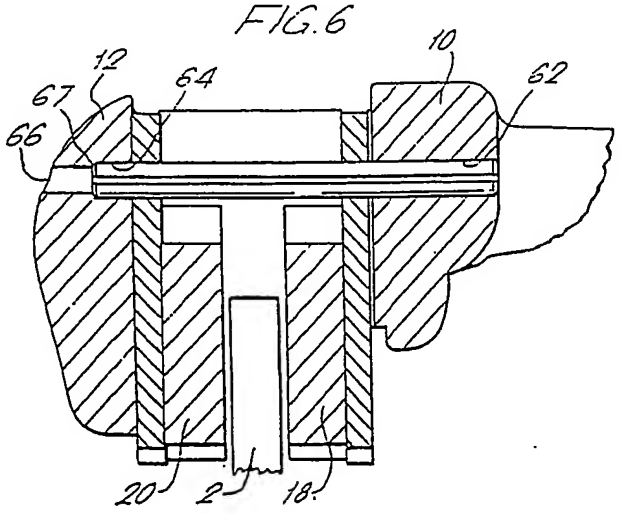

FIG. 7.

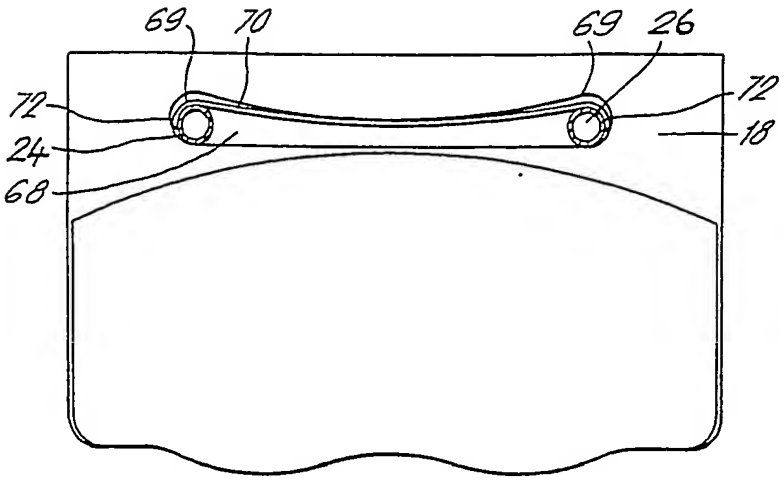

FIG. 8.